

CLAIMS

1. An apparatus for oscillating a surface, the apparatus comprising an oscillator circuit having:

- 5           a) a piezoelectric crystal connected to the surface;
- b) a variable frequency generator for generating a driving signal which is supplied to the crystal to cause the crystal to oscillate, thereby
- 10           causing the surface to oscillate; and,
- c) an analyser for monitoring the phase shift between the voltage across the crystal and the current flowing through it and, in response, generating an adjustment signal which relates
- 15           to the difference between the oscillation frequency and a resonant frequency of the crystal, the variable frequency generator being responsive to the adjustment signal to vary the frequency of the driving signal to cause the
- 20           crystal to oscillate at the resonant frequency.

2. Apparatus according to claim 1, wherein the variable frequency generator comprises a frequency synthesizer.

3. Apparatus according to claim 2, wherein the frequency synthesizer is supplied by a reference

25 frequency from an oven controlled crystal oscillator.

4. Apparatus according to claim 2, wherein the frequency synthesizer is supplied by a reference frequency from a voltage controlled crystal oscillator.

5. Apparatus according to any of the preceding claims, wherein the variable frequency generator additionally

30 generates a quadrature signal that is shifted in phase by 90° from the driving signal.

6. Apparatus according to claim 5, wherein the analyser comprises two quadrature modulators, one receiving the

35 driving signal, the quadrature signal and a signal representing the voltage across the crystal and the other receiving the driving signal, the quadrature signal and a

signal representing the current flowing through the crystal.

7. Apparatus according to claim 6 when dependent on claim 2, wherein the adjustment signal controls the operation of the frequency synthesiser thereby changing the frequency of the driving signal.

8. Apparatus according to claim 6 when dependent on claim 4, wherein the adjustment signal controls the frequency of oscillation of the voltage controlled crystal oscillator thereby changing the frequency of the driving signal.

9. Apparatus according to any of the preceding claims, further comprising a voltage controlled amplifier for controlling the amplitude of oscillation of the crystal.

10. A method for oscillating a surface, the method comprising:

- a) producing a driving signal that causes a piezoelectric crystal connected to the surface to oscillate thereby causing the surface to oscillate;
- b) monitoring the phase shift between the voltage across the crystal and the current flowing through it and, in response, generating an adjustment signal which relates to the difference between the oscillation frequency and a resonant frequency of the crystal; and,
- c) varying the frequency of the driving signal in accordance with the adjustment signal such that the crystal oscillates at the resonant frequency.

11. A method according to claim 10, wherein the driving signal is produced by frequency synthesis from a reference frequency.

12. A method according to claim 11, wherein the reference frequency is temperature stabilised.

13. A method according to claim 11, wherein the reference frequency is voltage controlled.

14. A method according to any of claims 10 to 13, wherein the voltage across and current flowing through the crystal are monitored and the adjustment signal is related to the phase shift between the voltage and  
5 current.

15. A method according to claim 14, wherein a quadrature signal that is in quadrature with the driving signal is also produced, the driving signal and quadrature signal both being mixed with a signal representing the voltage  
10 across the crystal and with a signal representing the current flowing through the crystal.

16. A method according to any of the preceding claims, further comprising controlling the amplitude of oscillation of the crystal.

15 17. Use of apparatus according to any of claims 1 to 9 for separating from the surface an analyte that has been immobilised on the surface.

18. Use of a method according to any of claims 10 to 16 for separating from the surface an analyte that has been  
20 immobilised on the surface.